CEREAL SCIENCE today

JANUARY 1961 • VOL. 6 • NO. 1 • 35c COPY

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Membership in the AACC is open to professionally qualified individuals anywhere in the world. Corporate memberships are available for those companies wishing to lend industry support to the scientific work of the Association. An application form for membership may be obtained by writing the American Association of Cereal Chemists, 1955 University Avenue, St. Paul 4, Minnesota.

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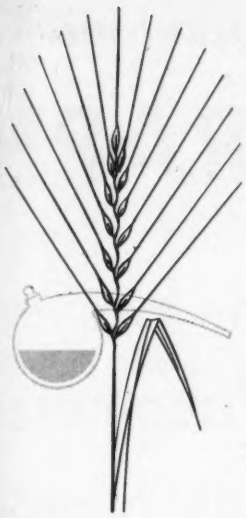

FEATURES

COVER: Steel storage bin, Russell-Miller Milling Co., Minneapolis

CEREAL SCIENCE today

JANUARY 1961 VOLUME 6 NUMBER 1

DEPARTMENTS

CEREAL SCIENCE Today is published ten times per year (monthly except June and August) by the American Association of Cereal Chemists, from 500 South 5th Street, Minneapolis 15, Minnesota. Editorial, Circulation and Advertising Headquarters: 1955 University Avenue, St. Paul 4, Minnesota. Second class postage paid at Minneapolis, Minnesota.

The American Association of Cereal Chemists assumes no responsibility for the statements and opinions advanced by contributors to its publications. Views expressed in the editorials are those of the editors and do not necessarily represent the official position of the American Association of Cereal Chemists.

Subscription rates: 1 year, $3.00; 2 years, $5.00; 3 years, $7.00. Foreign postage: $1.00 per year extra. Back issues available on request. Single copies: 35 cents.

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STAFF

editorial

SANITATION IS A word with different meanings depending upon the time and context in which it is used. To the flour miller today it largely implies control of insect and rodent infestation. In those branches of the food industry where raw materials and products are more perishable or are potentially capable of being disease vectors, it suggests applied bacteriology.

As new food products, new processes, and novel methods of distribution are devised and become commercially significant, the need for new and more complete information about certain food ingredients becomes apparent. That this is true for flour as used in some of the new convenience foods is illustrated in the article, "Flour Bacteriology and Its Public Health Significance" by Dr. G. M. Dack which appears on page 9 of this issue.

Grain and grain products produced by dry milling procedures are not sterile. Fortunately, most of the microorganisms associated with these commodities are not pathogenic and are incapable of growing at the moisture levels commonly found when sound practices have been followed. Nevertheless, there is a need, as Dr. Dack points out, to know what these organisms are, where they come from, how many there are, how they may affect the keeping qualities of foods in which they may grow, and whether they present a public-health hazard.

Because the bacteriological picture of a food largely reflects the sanitary practices surrounding its production, cereal chemists have an obligation to enlarge their knowledge of the bacteriology of the products with which they deal. They will then be better prepared, on the one hand, to assist in efforts toward product improvement and, on the other, to defend cereal products against unwarranted criticism from those who are less well informed on this important subject.

PAUL E. RAMSTAD

The Effects of Processing on

Biochemical Changes in Grains[1]

By W. H. Hastings and G. D. Miller

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BIOLOGICAL DATA HAVE indicated that digestibility of feedstuffs is affected by processing. For ruminants, the feeding value of whole grain is improved by grinding (3), the efficiency of feed conversion being somewhat related to particle size (6, 8). For poultry, pelleting significantly improves growth and feed conversion in chicks and poults, even though pelleted rations are reground to the texture of the original mixture (1).

The biological value of many feedstuffs can be evaluated by laboratory tests. For example, the efficiency of processing soybean oil meal has been measured by its urease activity, protein solubility, availability or destruction of amino acids, and the refractive index of dilute sodium hydroxide extracts. The relative digestibility of animal protein feedstuffs has been measured by *in vitro* pepsin digestion, combined with a study of the indigestible residue. No laboratory test for carbohydrates has been related to the biological value of this nutrient class.

An attempt is often made to relate the biological value of predominantly carbohydrate feeds to their fiber and nitrogen-free extract (NFE) components. However, within the NFE class differences in digestibility are not usually detected by chemical measurements. Data recently compiled[3] on apparent digestibility, milk and butterfat production, and calf growth resulting from feeding commercial blends of sorghum grains and corn processed by different methods, reveal significant differences, due chiefly to the NFE component. Previously[4] an appraisal of various varieties and hybrids of sorghum grain has shown that although there was an individual preference for products and processes with cafeteria-style feeding, any product was acceptable when offered alone. Practically, then, the product with the highest digestibility is the most desirable. Samples of material prepared for biological tests were used in determining the chemical and physical effects of processing reported in this paper.

Materials and Methods

Sorghum grain and corn were roll-cracked, hammermill-ground, steam-crimped, and pelleted (using a die 3/16 in. in diameter) in amounts necessary for biological tests; commercial milling equipment installed in the Kansas State University Experimental Feed Mill was used. Samples were prepared in a laboratory divider and ground through a 30-mesh screen of a Wiley Jr. mill. Materials prepared in the laboratory to simulate conditions found in commercial processing and containing added water were dried in a forced-air oven at room temperature before grinding.

A laboratory closed die and universal pressure testing machine were used to compress grains, with loads up to 100,000 lb., as might occur in commercial pelleting. The base plate of the die assembly was bored to permit thermocouple wires to be led into the die hole and joined midway in the formed pellet. Material compressed with this die measured 1.471 in. in diameter and approximately 2 in. long and, using pressures higher than 6,000 p.s.i.g., had the quality of hard pellets.

Total water-solubles were determined by a modification of the method of Leach, McCowen, and Schoch (5). A 1:20 (dry weight to water) suspension of the test material was extracted at 50°C. for 30 minutes and centrifuged at 2,000 r.p.m., and a 50-ml. aliquot of the clear supernatant evaporated as described. Reducing sugars were determined by ferricyanide reduction (2) on a 50-ml. aliquot of the extract. Another aliquot was acidified, autoclaved at 15 p.s.i.g. for 30 minutes (7), and tested for reducing sugars. The percentage of reducing sugars after hydrolysis minus the percentage present before hydrolysis, multiplied by 0.9, was reported as soluble starch. Soluble nitrogen was determined by the official AOAC Kjeldahl method on 75-ml. aliquots and reported as soluble protein (percent N × 6.25).

Gas production as a measure of the potential sugar level was determined by the Blish, Sandstedt, and Astleford method (2), both with and without the addition of amylytic enzymes. All data are reported on a dry basis.

Results and Discussions

Total solubles, reducing sugars, starch, and protein in the solubles are shown for corn in Fig. 1 and for sorghum grain in Fig. 2. Whole grains and their cracked and ground forms are quite similar in percentage of these materials. Pelleting caused an increase in total solubles and in soluble starch. Steam-crimped grains contained the least amount of soluble com-

[1] Contribution No. 338, Kansas Agricultural Experiment Station, Kansas State University, Manhattan. Presented at the 45th annual meeting, Chicago, Ill., May 1960.

[3] Unpublished data; F. C. Fountaine, E. Bartley, W. H. Hastings, and G. D. Miller.

[4] Unpublished data; W. H. Hastings, G. D. Miller, and G. M. Ward.

ponents of all products tested.

Since the process of pelleting is not standardized, the same specifications of pelleting sorghum grain were not possible for pelleting corn. This is due to differences in (a) the absorption of water and heat during steam conditioning before pelleting, and (b) pressure requirements to extrude the grains at the optimum rated amperage for the mill motor. Therefore, differences between pelleted sorghum grain and corn should be expected in biochemical values and mechanical effects.

Gas production for corn (Fig. 3) and sorghum grain (Fig. 4) at 5 hours was significantly greater for pelleted grains than for those prepared in other ways. No difference was found in gas production for whole, cracked, or ground grains; therefore only data for the cracked products are reported as representative of these processes. Gas production for steam-crimped grains was at the same rate as other products for 2.5 hours, but after that it lessened in amount per unit of time and did not appear to be capable of reaching the level produced from the whole, cracked, ground, or pelleted products.

Without the addition of alpha- and beta-amylase to assist in breaking down raw starch to reducing sugars, gas production by yeast growth depends somewhat on the presence of inherent enzymes. It was evident that steam-crimped grains had little active enzyme activity. Sufficient enzymes were concentrated in other processed grains to produce an increasing amount of gas during the testing period. Since gas production without enzyme supplementation is a measure of substrate digestibility and an indication of the presence of inherent enzymes, it was concluded that the pelleting process, which included a short-time temperature of 200°F., was not destructive to inherent enzymes and that it caused an increase in gas production over unpelleted products.

To find the cause of increased gas production and water-solubles observed in pelleted grains, several feedstuff samples were subjected to increments of temperature, moisture, and compression as contributed in varying amounts during commercial pelleting. All materials

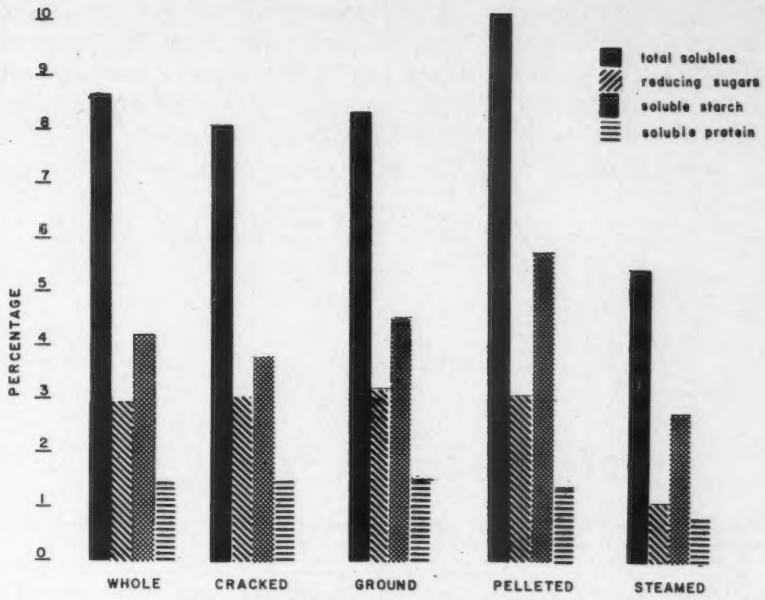

Fig. 1. Water-soluble components of processed corn.

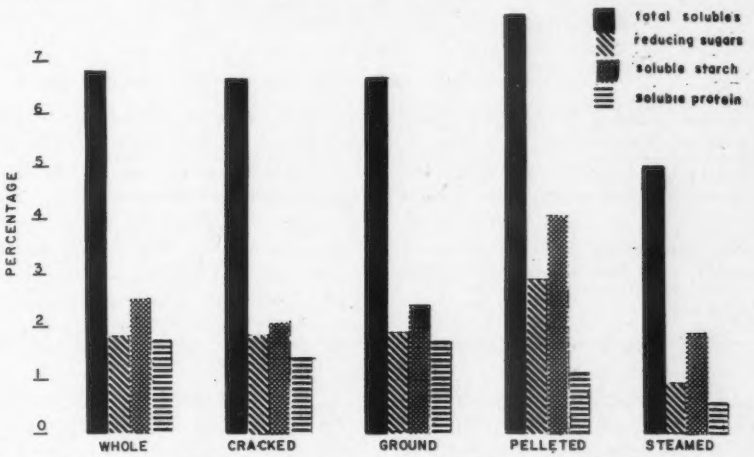

Fig. 2. Water-soluble components of processed sorghum grain.

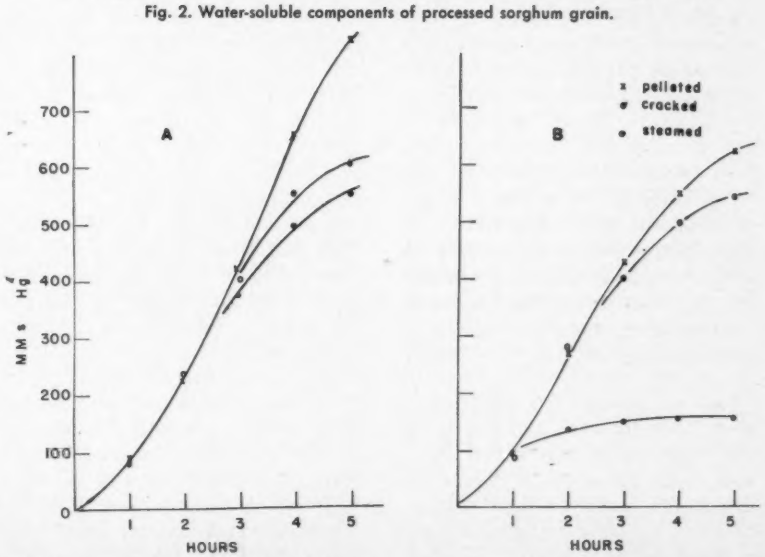

Fig. 3. Gas production, pressuremeter method, in processed corn. A, with added alpha- and beta-amylase; B, without alpha- and beta-amylase.

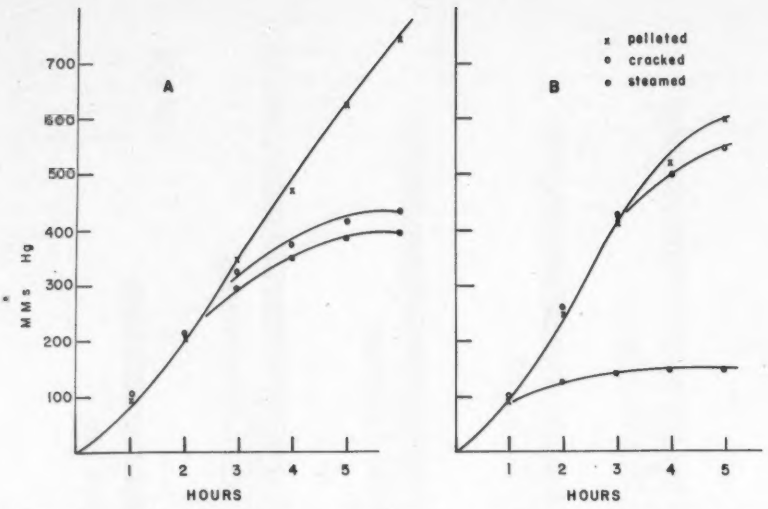

Fig. 4. Gas production, pressuremeter method, in processed sorghum grain. A, with added alpha- and beta-amylase; B, without alpha- and beta-amylase.

Table 1. Gas Production in Compressed Feedstuffs — Pressuremeter Method

Product	*Laboratory Die, 1,000-p.s.i.g. Load*					*Commercial Pellet Mill*
	0	*6*	*12*	*24*	*48*	
	mm Hg	*mm Hg*	*mm Hg*	*mm Hg*	*mm Hg*	*mm Hg*
Ground sorghum grain (commercial blend)	297	312	333	376	384	
Same — 6% added water	314	371	420	424	432	
Same — steamed	229	255	297	317	324	
Same — heated in can	335	433	432	420	433	
Same — 11% added water	697	815	(extruded through thermocouple holes)			
Raw wheat starch	183	190	225	238	493	
Ground alfalfa hay	236					430
Complete sheep feed (60% hay, 40% grain)	244					859
Laying ration	489					594
Dog food	351					457

showed an increase in gas production when compressed, either in a laboratory die or by a pellet mill (Table I). No significant increase in water-solubles was found in laboratory-compressed samples. (This work is continuing and will be reported later.) Except when steam-conditioning was done, water and heat added to a control grain material allowed an increase in gas production, when treatment was immediately followed by compression. Samples held for some time before compression showed gas production values similar to those of steamed material. Grains responded to low pressures, as normally found in commercial pelleting, with little increase in gas production when more than 12,000 p.s.i.g. was used. However, a sample of raw starch resisted a significant increase in gas production until higher pressures were used.

A temperature-calibrated Rubicon potentiometer indicated that the temperature within the material, at the junction of the thermocouple wires, increased from 75° to 94°F. during addition of 100,000 lb. of load (about 60,000 p.s.i.g.). The same increase (about 20°F.) was found with the use of a hot die and heated, wetted grains, starting at 205°F. It was noticed that as successive samples were pressed, the die became too hot to handle without protection. Since this heat was not indicated by the potentiometer, it was concluded that the friction of shear accompanying pelleting caused a surface heat which was imparted to the metal.

Biological data are insufficient at this time to evaluate biochemical results in terms of animal production. Individually fed chicks show greater growth on low levels of pelleted purified starch added to a complete basal ration than with unpelleted material, but are unable to consume sufficient ration at high levels of starch addition to complete the assay. With dairy heifers, the apparent digestibility of the NFE component of the dry matter of pelleted sorghum grain showed a 5% increase[5] over cracked grain and for beef cattle a 6% increase (4).

Summary

Gas production, total solubles, reducing sugars, and soluble starch are highest in pelleted and lowest in steam-crimped grains. Statistical tests using the LSD (least significant difference) procedure to separate the means showed pelleted material to be significantly greater in these values, and steam-crimped material significantly lower in total solubles and soluble protein, than other processed grains. The soluble protein component for pelleted material was less than for whole material and greater than for steam-crimped material.

Pressure involved in pelleting apparently causes changes in the starch structure, which are reflected in measurements of gas production by the method used. Compression by itself up to 60,000 p.s.i.g. apparently is not a major factor in heat production during pelleting. The shear accompanying pellet formation and discharge from a die may be associated with the biochemical changes observed in the test material. The accompanying friction causes a surface heat which is imparted to the die metal rather than the material.

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[5] Unpublished data; F. C. Fountaine, E. Bartley, W. H Hastings, and G. D. Miller.

EDITOR'S NOTE: We are pleased to be able to present this article by Dr. G. M. Dack, Director of the Food Research Institute at the University of Chicago, and an internationally recognized authority on food bacteriology and its public health significance. Dr. Dack is the author of numerous publications in this field including the book "Food Poisoning", University of Chicago Press, Chicago, Illinois.

Public
Health
Significance of

Flour Bacteriology

By G. M. Dack

Food Research Institute and Department of Microbiology
University of Chicago, Chicago, Illinois

FLOUR HAS A history dating to the beginning of civilization. Because most foods prepared from flour were usually baked or otherwise cooked before serving, any contaminating microorganisms, unless they caused spoilage, were insignificant. Microorganisms of public-health significance were thus destroyed in cooking or baking. Interesting in this connection is "salt-rising" bread in which the starter in the sponge is *Clostridium perfringens* (5). Many reported outbreaks of food poisoning are attributed to certain strains of this microorganism. It has not been established that the starters for the "salt-rising" sponge are nonfood-poisoning strains. As far as the author's experience goes, no food-poisoning outbreaks have been attributed to "salt-rising" bread.

Microorganisms in Flour

Since many convenience food products containing flour are tested microbiologically as they are purchased and before cooking, it is important to evaluate the number and kinds of microorganisms contributed by the flour ingredient. Many products can be produced under good conditions of handling and sanitation with low total bacterial counts. If counts are high, there may be mishandling of the product in the plant or after it leaves the plant; or a high count may be related to some of the raw ingredients used in the product.

Obviously, the miller wishes to keep abreast of changing conditions affecting his product. Furthermore, a knowledge of the microbial content of flour is helpful to him in judging the state of sanitation under which his mill is operating, as well as the sanitary quality of the raw grain going into flour. It is not the purpose of this paper to recommend a proposed code for microbiological standards for flour, but merely to point out the usefulness of in-plant microbiological standards for the miller in maintaining high quality.

Disease Outbreaks

Although the author in no way is implicating flour dust in a factory as the cause of salmonellosis, an episode with another food product will illustrate what might happen with a dust containing large numbers of Salmonella. Cakes in an English bakery were contaminated with Salmonella from American egg albumen powder dust, causing a large number of illnesses in consumers of these products (6).

In New South Wales, in 1952, there occurred a series of eight outbreaks of paratyphoid fever. All were associated with bakeries selling cream buns and the like. The fact that the eight outbreaks were caused by a single phage type of *Salmonella paratyphoid* B, namely type 1, suggested that a common ingredient had been used in all the bakeries concerned. First suspicion fell on synthetic cream, but the supplier of this product had sent cream to other parts of the country where there had been no paratyphoid fever. An exhaustive study turned up only one other article that was distributed to all the bakeries – flour from a single mill in Cardiff. A symptomless excreter of paratyphoid bacilli had been working at this mill and may have been responsible for contaminating the flour; laboratory experiments showed that paratyphoid bacilli might remain alive in dry flour for several months. Supporting evidence was lacking, however – attempts by many laboratories to demonstrate the presence of Salmonella in flour proved consistently unsuccessful.

Contamination in Wheat

Wheat, as it grows, is subject to contamination from dust and soil. If the soils are manured, enteric organisms may contaminate kernels that fall to the ground before harvesting. This is particularly apt to occur in years of high moisture and in the presence of storms. The crease in the kernel may fill with foreign matter, which may contaminate the milled product. After threshing, if stored in unclean bins or not protected from birds and rodents, the grain is subject to further contamination; fowl and rodents are notorious carriers of Salmonella. Therefore, wheat before it reaches the miller may have become grossly contaminated in the field and during handling, storage, and shipping.

As pointed out in *Storage of Cereal Grains and Their Products* (1), many bacteria are removed

during the milling process, because the outer portions of the kernel contain the largest number of microorganisms. This book refers to Turley (8), who in 1922 found bacterial counts ranging from 710,000 to 5,200,000 per g. of flour. Fred (3) in 1929 found 18,000 to 60,000 bacteria per g. in flours from different sources. Holtman in 1935 (4), in examining 21 brands of flour obtained on the market, counted 3,100 to 7,500 bacteria per g.; mold spores varied between 100 and 640 per g.

Mill Sanitation

Thatcher *et al.* (7) in 1953 made a survey of 50 representative Canadian flour mills in order to study the relationship between sanitation in the mill and the microbial and insect-matter content of the flour. The mills practicing a superior quality of sanitary control produced flour with insect and microbial values lower than the median values for all mills. Furthermore, flour from heavily infested mills had about 7.5 times as many microscopic insect fragments as the average values of all the rest and, bacteriologically speaking, was 5.5 times dirtier.

In an investigation of microorganisms in flour from five superior mills and from five substandard mills, the following were found:

	Superior *av/g*	*Substandard* *av/g*
Mesophile plate count:		
Nutrient agar, 37°C.[a]	7,300	825,000
Potato-dextrose agar, 22°C.[a]	3,300	12,000
Mesophile bacterial spores	95	600
Molds	2,200	11,000

[a] Incubation temperature.

The numbers of thermophile "flat sour" spores and anaerobic spores were small for flour from both the superior and substandard mills.

In the author's experience, ten flour samples were examined in plants preparing precooked frozen foods. The counts ranged from 575 to 18,300 per g. and the mode was approximately 7,000. Four of the ten samples had bacterial counts of over 10,000 per g. Of the ten samples, coagulase-positive staphylococci were found in two; in one of the samples in a 1:10 dilution and in the second in a 1:100 dilution. Five of the ten samples had coliform bacteria, two samples with a "most probable number" (MPN) of 3.6, one with 9.1, one with 23, and the last with 43.

From studies which the author and others have made, it appears that total counts may be variable, ranging from very large numbers of bacteria per g. of flour to less than 10,000 per g. Coliform bacteria may or may not be present in some flours and sometimes several hundred are reported. These organisms may or may not be of fecal origin. As Holtman (4) has shown for one mill, flour was produced with a count of 23,000 bacteria per g., but after warehouse storage with a humidifier in use a count of 337,000 microorganisms per g. of flour was obtained. Obviously, the factors concerned with the number and kinds of bacteria in flour are 1) the microbial flora of the wheat when it enters the mill and 2) sanitation in the milling process. Also, flour may be contaminated after it leaves the mill, owing to improper handling and storage conditions.

Convenience Foods

In another article concerning the significance of enteric bacilli in foods (2), the author has pointed out that coliform bacteria, probably of intestinal origin, are a part of our everyday menu, even where good public-health procedures and sanitary practices are carried out. Nevertheless, a food processor of convenience foods is concerned with following the best practices of sanitation in his plant, and it is important to him that raw ingredients such as flour do not contribute to a high bacterial count nor contribute microorganisms of public-health importance to his products. Apparently flour can be produced with a low microbial count and also with a small number of microorganisms of possible public-health importance. Certainly many of the coliform organisms contaminating wheat and flour are not of fecal origin, although this is not invariably the case.

Many refrigerated or frozen convenience foods are dependent upon a low temperature to prevent the growth of potentially pathogenic microorganisms. Products picked up at retail stores are usually examined for total numbers of bacteria which, if large, may reflect unsanitary practices in the plant or mishandling at temperatures supporting growth of bacteria after leaving the plant. Using the best sanitary practices and equipment, a plant may put out a product which will pass the most rigid microbiological examination, and yet this same initially good product may fail such a test subsequently if not kept properly refrigerated or frozen. If the treatment of the cooked ingredients in the product is adequate, only the most heat-resistant pathogenic microorganisms will survive, and there is little public-health danger from mishandling. However, a raw product such as flour may be a source of potential pathogenic microorganisms. From the public-health standpoint the record of most of the convenience foods is satisfactory, and it would appear that flour could be provided which would uniformly meet reasonable standards without greatly influencing its cost. More information is needed as to the significance of coliform organisms in flour. Consideration should be given to the multiplication of potentially pathogenic organisms entering a product through flour, and particularly to their fate in competition with the natural flora of the product when it is held at temperatures that support the growth of these microorganisms.

It is hoped that the milling industry can establish their own microbiological standards for flours reflecting a good raw product, care in handling, and sanitation in milling.

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A SIMPLE VOLUME-MEASURING DEVICE FOR 8-INCH ROUND LAYER CAKES

The volume meter described below and the accompanying conversion chart were developed to give a rapid and more reproducible method for estimating volumes in cc. on the 8-in. round layer cake than is available with the rapeseed displacement method.

The method reflects shrinkage and volume by measurement. The chart gives volume in cc. The most important single contribution provided is the improved agreement between operators. Although it is not general practice, volumes can be estimated on the hot cake.

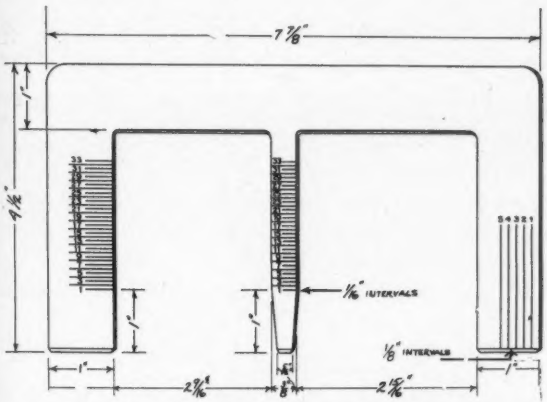

Fig. 1. Dimensions of volume meter for 8-in. round layer cakes.

Figure 1 shows the dimensions for the E-shaped calibrated device, made of 0.048-in. stainless steel. The height measurements are at 1/16-in. intervals, numbered beginning with 1 at the 1-in. mark from the base. The three legs are tapered at the base for ease in inserting into the cake. The vertical lines measure shrinkage at ⅛-in. intervals, numbered from right to left.

In the volume meter chart, four columns numbered 0 to 3 reflect shrinkage from zero to ⅜-in. Average height is shown in the left-hand column, the body of the chart consisting of volumes in cc.

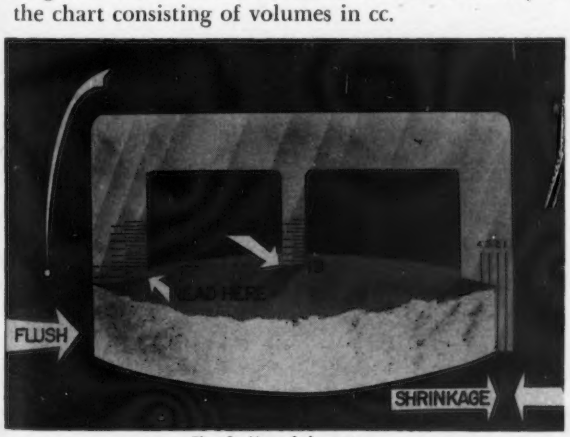

Fig. 2. Use of the meter.

Volume Meter Chart

Average Height	*Shrinkage* 0	1	2	3
5.0	905	870	840	810
5.5	930	895	865	835
6.0	955	920	885	855
6.5	980	945	910	880
7.0	1,005	970	935	900
7.5	1,030	995	960	925
8.0	1,055	1,015	980	945
8.5	1,080	1,040	1,005	970
9.0	1,105	1,065	1,025	990
9.5	1,130	1,090	1,050	1,015
10.0	1,155	1,115	1,075	1,035
10.5	1,180	1,140	1,100	1,060
11.0	1,205	1,160	1,120	1,080
11.5	1,230	1,185	1,145	1,105
12.0	1,255	1,210	1,170	1,130
12.5	1,280	1,235	1,195	1,150
13.0	1,305	1,260	1,215	1,175
13.5	1,330	1,285	1,240	1,195
14.0	1,355	1,305	1,260	1,220
14.5	1,380	1,330	1,285	1,240
15.0	1,405	1,355	1,310	1,265
15.5	1,430	1,380	1,335	1,285
16.0	1,455	1,405	1,355	1,310
16.5	1,480	1,430	1,380	1,330
17.0	1,505	1,450	1,400	1,355
17.5	1,530	1,475	1,425	1,375
18.0	1,555	1,500	1,450	1,400
18.5	1,580	1,525	1,475	1,420
19.0	1,605	1,550	1,495	1,445
19.5	1,630	1,575	1,520	1,470
20.0	1,655	1,600	1,545	1,490

Directions for Use.

1. Allow cake approximately 1 hour for cooling after removal from the oven.

2. Insert volume meter in cake removed from pan, in such a manner that the left-hand numbering gage is flush with the left edge of the cake. Use fingers as a guide.

3. Read shrinkage at right-hand edge. Read right-hand line whenever any part of the cake extends within the two lines.

4. Read the center and left-hand gages and average the two figures.

5. Refer findings to chart for volume in cc.

Example: For shrinkage 2 as in Fig. 2, use the No. 2 column on the chart. The center gage reads 19, the left-hand gage reads 13, averaging 16. For 16 average height and number 2, the chart reads 1,355 cc. volume.

Note: If cake is not symmetrical, use judgment in determining the point at which the meter is inserted, making sure that neither the high nor low side is taken; or if desired, take both the high and low readings and record the average.

Summary. Because cake presents an uneven surface, the resulting volume obtained may not always duplicate rapeseed displacement. For one who wishes to think in terms of volume in cc., this method improves reproducibility of results between operators.

DEAN E. WILBUR AND ERNEST W. JOHNSON

General Mills, Inc.
Minneapolis

STRAIGHT-TUBE MANOMETER METHOD FOR SODA IN PREPARED MIXES

A rugged, easy-to-operate instrument utilizing high vacuum, a direct-reading manometer, and a special stirring device provides a rapid, dependable method for performing a large number of soda determinations on a routine basis.

The straight-tube manometer, shown in Fig. 1, reads absolute pressure on a centimeter scale permanently mounted on the left side of the mercury column. A movable centimeter scale is mounted on the right side of the column. The percent soda is read from this scale. The apparatus is calibrated so that 1% soda in a 20-g. sample is equivalent to 10 cm. of mercury. Temperature is corrected by positioning the movable scale so that the zero mark is the proper distance above the theoretical zero point. Temperature corrections are determined experimentally and inscribed on the movable scale.

Fig. 1. Manometer.

The sample is placed in a 200-ml. Berzelius beaker and capped with a two-holed rubber stopper through which pass an acid delivery tube and a connecting tube to the manometer. A vacuum is drawn to 14 cm. absolute pressure. The right-hand scale is positioned to read zero minus the temperature correction. Forty milliliters of 1:5 sulfuric acid-water solution are delivered into the beaker in two steps to avoid excessive bubbling. The stirrer is turned on and, 2 minutes after the initial addition of acid, the percent soda is read from the right-hand scale by dividing the centimeter reading by ten.

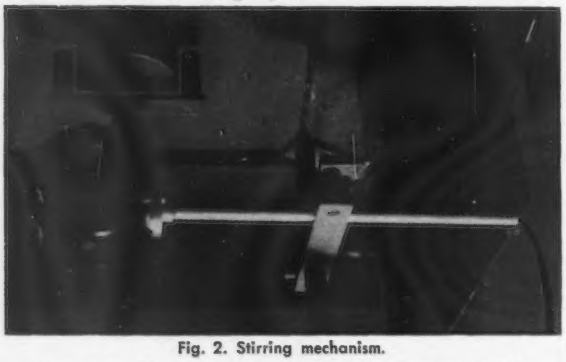

Fig. 2. Stirring mechanism.

The specially designed stirring mechanism is shown in Fig. 2. The beaker sits in a plastic well 1½ inches deep. Two opposed magnets mounted on a steel saddle are powered by a 1/40-h.p. motor. The saddle is placed below the well with the vertical bar magnets on opposite sides of the sample well. These magnets drive a magnetic stirring bar within the beaker.

The instrument is calibrated using the ideal gas law. The moles of carbon dioxide evolved from sample standards is known, as is the temperature. The volume of the system is adjusted by use of oil in a trap located between the beaker and the manometer. The volume is adjusted so that there is a 10-cm. pressure differential for every percent soda in a 20-g. sample. The theoretical volume is calculated, then standards run, and from the pressure differentials obtained actual volume is estimated. The difference between actual and theoretical volume is corrected by adjusting the oil level in the trap. It has been found necessary to repeat this procedure several times before known samples read as desired.

The determination as routinely run is as follows:

a) Weigh 20-g. sample in beaker, add magnetic stirring bar;
b) place beaker in well, press on stopper;
c) close air valve, open vacuum valve until mercury level reaches 14 cm., close vacuum valve;
d) set temperature correction;
e) deliver 20 ml. acid, turn on stirrer, start timer, wait for foam to subside;
f) deliver other 20 ml. acid, wait until timer reads 2 minutes;
g) read manometer on right-hand scale, record result;
h) open air valve, fill acid buret, remove beaker.

The major advantages of this test are: test results are available within 5 minutes after starting; the test is not affected by other ingredients normally found in mixes, and reproducibility is good, the two-sigma variation being 0.015% soda in one study of 100 known samples. Air leakage is the most common malfunction encountered. When this leakage occurs, it will usually be found around the stopper in the sample beaker, or in the vacuum or air valves. The system may easily be checked by delaying addition of acid at the beginning of a determination. If the mercury level does not move, the system is tight. Soda values will be depressed for mixes containing shortening, but this depression is consistent, so adjustment of control limits is possible to account for it. The temperature correction is based on room temperature which assumes equilibrium between room temperature and the temperature of the equipment, acid, and sample. Experience has shown this assumption is valid.

The cost of parts to construct a unit is approximately $275.00. The method requires very little technician training. Technician work time per determination is 2.5 minutes, and total time for completion of a determination is less than 5 minutes.

ROBERT G. PIPPITT

The Pillsbury Co.
Hamilton, Ohio

LAYER CAKE VIEWING DEVICE

The most common cake form used in test baking work is the round layer, usually baked in pans 8 in. in diameter and 1½ in. deep. To examine a number of cut layer cakes side by side in flat attitude takes up extensive bench or work space, and spreads out the items for direct comparison to an undesirable length. To make more critical and direct comparisons of the various cakes, they must be handled several times so that each in turn is immediately adjacent to each of the others.

We have constructed a semicylindrical trough mounted on its axis, on two legs. The axial projections are threaded and fitted with wing nuts which can be loosened so that the angle of the trough can be controlled. It is painted dull black to avoid the interfering reflection of light. Cut 8-in. layers fit snugly on edge in the trough, side by side, thus exposing the crumb of all the cakes in close proximity to each other. (See photo.)

The proper angle of incidence of light to bring out closest discrimination between textures is achieved by tilting the trough. Harrel *(Cereal Chemistry 7;* 313; 1930) has shown that it is important to obtain the best angle of incident light in viewing or photographing grain and texture.

Color can likewise be scored while the cakes are in the viewing device. It can also be used to carry a number of cakes to a better light source, or to show to persons at a different location.

HARRY J. LOVING

Mennel Milling Co.
Fostoria, Ohio

METHOD FOR DIRECT-READING MOISTURE DETERMINATION

In a mill quality control situation, accuracy and speed are equally important. Moisture determinations are usually made by the air-oven method (*Cereal Laboratory Methods,* 6th ed., Sec. 48.3a). We use the air-oven method, weighing back the dried flour by a procedure in which the only clerical operation is the recording of the moisture content. A pharmaceutical-type torsion balance with smallest division of 0.01 g. and with slide measuring from 0 to 1.0 g. is required (capacity 120 g., sensitivity 4 mg.). We use tared aluminum dishes 70 mm. in diameter and 17 mm. in height, with tight-fitting slip-on covers. Each dish and cover are numbered, and adjusted to the same total weight (± 5 mg.). One 10-g. and one 9-g. weight are also needed.

Step one is to weigh exactly 10 g. of flour (or other cereal material to be tested) into the dish on the right-hand pan, the filled dish being balanced by an empty covered dish and 10-g. weight on the left-hand pan. This is the reverse of the usual practice, which is to place weights on the right-hand pan, and materials being weighed on the left-hand pan. The reason for this reversal will be made clear.

After the flour has dried in open dishes in the air oven under standard conditions (130°C. for 1 hour), the dishes are covered and removed to a copper plate 6 mm. thick, to expedite cooling. When cooled, the covered dish containing dried flour is again placed on the right-hand pan, this time with an empty tared dish and the 9-g. weight on the left-hand pan. With the slide set at zero and the system in balance, 10.0% moisture would be indicated (i.e., 1 g. lost from 10 g. of original flour). As the slide is moved to the right to balance greater moisture loss, the range of the slide extends from 10.0 to 20.0% moisture, by 0.1% gradations. Hundredths can be estimated, but this precision is not required for mill control work, and is doubtless closer than the reproducibility of the test itself. One replaces the 9-g. weight with the 10-g. weight for reading moisture below 10%.

The large sample (10 g.) reduces sampling error and contributes to accuracy.

Reading moisture direct in this way gives complete freedom from arithmetical computation or work-sheet operation. Errors in computation and copying are therefore virtually eliminated. In our laboratory we have found it possible to weigh back, read, and record ten moisture determinations within 2½ minutes, or less than 15 seconds per sample.

C. A. NELSON AND HARRY J. LOVING

Mennel Milling Co.
Fostoria, Ohio

CORRECTION

CEREAL SCIENCE TODAY, Vol. 5, No. 8

(October, 1960)

"A Method for the Determination of Inorganic Bromide Residues in Grain and Cereal Products"

Report of AACC Pesticide Residues Committee, 1960

On page 253, *Calculations* should read:

$$\frac{Tx \times 0.1332 \times 1000}{W} = \text{p.p.m. inorganic bromide,}$$

where Tx = . . . W equals the weight of the sample in grams.

PUBLIC HEALTH IN REVERSE

Biological Warfare

AMONG RADIOLOGICAL, biological, and chemical agents, biological warfare agents—one of the most diabolical types of modern weapons—currently present the greatest problem of early detection of an attack. Disability and death can strike infected man and animals through prolonged and painful illness. The first knowledge that we have been subject to covert or even overt biological attack may come from localized or widespread outbreaks of disease.

Biological warfare consists of the production and dissemination of different kinds of microorganisms, or their toxins, which produce debilitating disease and/or death in man, animals, and plants. Modern research shows that the smallest, financially poorest nation on earth could have, or could easily acquire, the knowledge to provide itself with a substantial capability to wage biological warfare.

Biological warfare is not unknown in history, but the greatest losses to military forces from disease usually came from natural causes. No all-out effort at biological warfare is recorded in history, so we can only predict what the actual outcome would be, on the basis of knowledge gained in research.

Chemists in food plants, such as AACC members, would be more valuable to their company and to the nation in case of an emergency due to enemy attack if they knew more about the nature of biological warfare agents, how they might be used as weapons, and how to detect their presence in food or on its containers. This knowledge should also include protection to personnel (including themselves) working around and with contaminated food; decontamination of the contaminated container surfaces and their contents; and destruction, with safety, of that which could not be decontaminated. Since BW agents are so easily adapted to clandestine attack, a knowledge of how to prevent this type of attack is vitally important.

One method of early detection is the fluorescent antibody technique. The necessary equipment (microscopes, ultraviolet lights, filters, etc.) has already been developed to a high degree of perfection. Some organisms which could be used as biological warfare agents are rapidly detectable by this method. Research is under way to test its applicability to other warfare agents. Much more research needs to be done in this field.

No foolproof air-sampling method of testing, which could be tied into an early-warning system, has been developed although much research has been carried out in this area.

AACC members attending the annual convention in Dallas, Texas, April 9–13, 1961, are urged to remain for the 1½-day Civil Defense Training Course to be given by the U. S. Food and Drug Administration on April 13 and 14, where these and other matters pertaining to biological warfare will be discussed.

• • • People

E. J. Bass now with International Milling Co., Minneapolis; formerly with Board of Grain Commissioners for Canada, Winnipeg.

Bee Braden named manager of test bakery, The Pillsbury Co.'s bakery products division, Minneapolis; from technical service representative for Pillsbury in Atlanta district.

Charles E. Day, a member of the AACC since 1934, died on November 5, 1960. He was employed in the Products Control Dept. of the Rodney Milling Co., Kansas City, Mo.

Mr. Day was a graduate of Stanford University and the AIB. His career in cereal chemistry began in the laboratories of the Sheridan Flouring Mills.

He is survived by his wife, three sons, and three daughters.

Norris D. Embree appointed v-p in charge of technical operations at Distillation Products Industries, Rochester, N.Y.; has been technical director since 1957.

C. G. Harrel becomes consultant to Red Star Yeast & Products Co. on product improvement and new product development; he has been and continues to be associated with product research staff of Seymour Foods, Inc., Topeka, Kansas.

John A. Johnson, AACC National President, was honored on December 6 by Gamma Sigma Delta, agriculture honorary fraternity, for 10 years of "diligent service, farsighted views, and interest in the fraternity." The recognition was given at a luncheon at Kansas State University, open to friends in addition to fraternity members.

Ben Redman's recent passing is reported from the Pacific Northwest. He was a past president of the AACC Local Section there, and one of the early members. He had been chief chemist for Montana Flour Mills Company for a number of years until his retirement in 1958.

Frederick G. Merckel, director and retired president of Wallace & Tiernan Inc. of Belleville, N.J., died of a heart ailment in London, England, on October 29 after a short illness. He was 64 years old.

Mr. Merckel was manager of the Chicago Office of W&T from 1921 to 1930, then transferred to the main office, and during the next 23 years participated in all activities of the company. He became its president in 1954 and served for five years. At the time of his death he was working on integration of W&T's operations in England and Germany with those of the United States.

He is survived by his wife, Florence; a son and a daughter, and six grandchildren.

• • • Products

Natural fermentation flavor. VICO 400 is a dry flavoring in powder form, highly stable, alone or in prepared mixes and frozen doughs, for imparting true yeast-leavened flavor and aroma in chemically leavened baked products without time-consuming dough fermentation. Its introducer affirms that it is especially effective in combination with the blander types of chemical leavening agents. For sample, technical information, and prices, write to Vico Products Co., 415 West Scott St., Chicago 10, Ill.

• • •

Mixer for feeds, cereals, etc. The Nauta Mixer, originated in Holland, will through special license be manufactured and sold in the U.S. and Canada by the J. H. Day Company. In the processing of feeds for livestock and poultry, prepared cereals, and similar products, where fast, highly accurate mixing of ingredients is essential, this mixer is of particular interest. It employs a fast three-way action providing accurate control of materials but reducing heat-generation. The conical container has a rotating screw positioned along its wall. As this revolves, it also orbits around the inside wall, resulting in vertical and horizontal cross-currents; the material is thus mixed and spiraled upward. Full details and specifications available from: The J. H. Day Co., 4932 Beech St., Cincinnati 12, Ohio.

• • •

Sorbistat®, manufactured by Chas. Pfizer & Co., Inc., is a food-grade preservative that retards microbiological destruction of foods and beverages. At low concentrations Sorbistat is effective against many molds and yeasts and certain bacteria. A new Pfizer Technical Bulletin, "No. 101, Sorbistat® – Sorbistat® – K," is available on request from the company's Chemical Division, 630 Flushing Ave., Brooklyn 6, N.Y.

• • •

• • • Patter

Award. The Food Law Institute's annual Award for Distinguished Food Law Services to the American people was presented to William J. Darby, as chairman of the Food Protection Committee of the National Research Council. The presentation took place at the Food Law Institute dinner, held in Washington D.C. November 28. Dr. Darby is on the staff of Vanderbilt University's School of Medicine.

In accepting the Institute's award on behalf of his Committee, Dr. Darby called for more attention by the scientific community to basic problems relating to assessment of food additives, and for further evolution in thinking toward removal of the last possibility that additives might be harmful to the consumer.

• • •

The Feed Microscopists' annual meeting will be held in Denver, June 19 through 21, with a Short Course June 19 through 24. Scheduling these two events together and in one week has required most careful planning by the program committee, but specific advantages are seen in it. Those attending both the Short Course and the meeting will save on travel time and expense. Because the Short Courses will thus be held in different locations along with the annual meeting, they can be offered to a greater number of people. The 1961 meeting will be streamlined by omitting the free evening, by compressing the elections and business meetings, and not scheduling any tours. Clyde E. Jones is chairman of the Program Committee.

Barley Improvement Conference. The Malting Barley Improvement Association will sponsor a conference to be held in Minneapolis, January 26, at the Pick-Nicollet Hotel.

Papers on the morning program include "Agronomic performance of barley varieties in the Midwest" – R. G. Shands; "Agronomic performance of two-row barley varieties in Western states"–H. V. Stevens and E. A. Hockett; "Results of experimental malting tests on barley varieties and new selections grown in 1959 and 1960" – Allan Dickson; "Distribution of barley varieties in Midwestern and Western states and acceptable varieties of malting barley for 1961" – A. J. Lejeune.

Afternoon presentations: "Progress in development of superior malting barley varieties for the Midwest" – Glenn Peterson; "Malting barley improvement in the Pacific Northwest" – R. A. Nilan; "New developments in the industry quality evaluation program" – L. A. Hunt; "The Canadian malting barley research program" – A. E. Hannah; and "Cooperative malting barley research – its significance to industry" – Stuart F. Seidl.

James G. Dickson, University of Wisconsin, Madison, will receive industry recognition for his work in plant pathology, and will speak on the subject "Where grows barley."

• • •

Scholarship endowed. The Albert P. Strietmann Memorial Scholarship (undergraduate) in the College of Engineering, University of Cincinnati, has been endowed through a gift of $50,000 to the university from the United Biscuit Co. of America.

CLASSIFIED

SITUATIONS OPEN

Applications are invited for a Faculty position in Agricultural or Cereal Chemistry. Duties involve direction of graduate research and teaching cereal and organic chemisty. Rank and salary dependent upon qualifications. Send resume to Head, Department of Chemistry, University of Saskatchewan, Saskatoon, Saskatchewan, Canada.

2nd ANNUAL INGREDIENT SYMPOSIUM

January 27 and 28, Peoria, Illinois

Sponsored by the Central States Section of the AACC

"Flour — Its Constituents and Their Roles" will be the subject of a symposium sponsored by the AACC's Central States Section. The symposium will be held in Peoria, Illinois on January 27 and 28.

The purpose of this meeting is to provide those attending with a current review of today's knowledge about wheat flour and its behavior in various food products. Each functional constituent will be discussed by an authority. Formal presentations will be followed by a panel discussion based on written questions from the floor. Written notes on each talk will be mailed to the registrants after the meeting.

An open invitation is extended to all AACC members and other interested parties in the cereal industry. The two-day session will include:

- Formal presentations
- Panel discussion with participation from the floor
- A tour of the USDA's Northern Utilization Research and Development Laboratories
- Evening dinner with guest speaker

Hotel reservations should be made well in advance by sending your requests to the registration chairman: John T. Watson, Anheuser-Busch, Inc., Dried Yeasts and Derivations Dept., 7th & Pestalozzi St., St. Louis 18, Mo.

PROGRAM

January 27

1:00-3:00 p.m. — Registration, Hotel Pere Marquette
3:00 p.m. — Tour of Northern Utilization R & D Laboratories
5:30 p.m. — Cocktails and Dinner, La Salle Room, Hotel Pere Marquette
7:00 p.m. — Keynote Speaker (to be announced)
7:40 p.m. — Proteins — Dr. James W. Pence, Western Utilization R&D Laboratory, Albany, Calif.

January 28

9:00 a.m. — Carbohydrates — Dr. R. M. Sandstedt, Dept. of Biochemistry and Nutrition, University of Nebraska, Lincoln, Nebraska
Lipids — Dr. Kenneth A. Gilles, Chairman, Dept. of Cereal Technology, North Dakota State University, Fargo
10:20 a.m. — Coffee Break
10:40 a.m. — Enzymes — Dr. Byron S. Miller, Dept. of Flour and Feed Milling Industries, Kansas State University, Manhattan, Kansas
Performance Evaluations—Dr. William T. Yamazaki, USDA Soft Wheat Quality Laboratory, Wooster, Ohio
12:00 noon — Lunch
1:00 p.m. — Panel Discussion — moderated by Emery C. Swanson, The Pillsbury Co., Minneapolis
3:00 p.m. — Adjourn

clip and mail

HOTEL RESERVATION FORM

Name _____

Address _____

Number of Persons _____

Type of Accommodation _____

Affiliation _____

Please mail this form as soon as possible to: John T. Watson, Anheuser-Busch, Inc., Dried Yeasts and Derivations Dept., 7th & Pestalozzi Sts., St. Louis 18, Mo.

the President's Corner

news of the association

As the Association enters a New Year, we may look to the past with pride and to the future and its challenges with enthusiasm. The Association is a sound and growing organization. It has found a respected place among professional societies. In 1961, certain contributions, now in the making, will become realities. The third monograph, *Chemical Technology of Wheat,* should summarize much of our present knowledge of one of our basic food materials. Good progress is being made toward publication of the 7th edition of *Cereal Laboratory Methods.* The publications of CEREAL SCIENCE TODAY and CEREAL CHEMISTRY will continue to be the voice of cereal chemistry in far-flung reaches of their respective circulations.

My wish for each of you is a Happy and Prosperous New Year and may you be richly blessed with the advancements being made in the field of cereal chemistry.

JOHN A. JOHNSON

ANNUAL MEETING OF AGRICULTURAL RESEARCH INSTITUTE

The Agricultural Research Institute was established in 1951 to provide a forum for unrestricted discussion of problems common to agricultural scientists in private industry, public agencies, and educational institutions. It also provides a means of organizing agriculturally related industries and private institutions in financial support of the Agricultural Board. The Institute was established and is operated under the auspices of the National Academy of Sciences-National Research Council's Division of Biology and Agriculture, wherein it is affiliated with the Agricultural Board. Membership in ARI consists of 67 Class A members, representing industry, and 99 Class B members, representing scientific societies, educational institutions, and Federal and State agencies. AACC was accepted for Class B membership in 1958.

The Ninth Annual Meeting of ARI was held in Washington, D.C., on October 17 and 18, 1960. Total registration was about 150. Featured on the program were panel discussions on the following general topics: 1) the place of engineering research in plant and animal production and utilization in our modern agriculture; 2) the interresponsibility of land-grant colleges, government, industry, and regulatory agencies with respect to agricultural research and interpretation of results to the public; and 3) recent advances and problems in the animal sciences.

Copies of the papers presented under any of these general topics can be obtained by writing to the Agricultural Research Institute, National Academy of Sciences, 2101 Constitution Avenue, Washington 25, D.C.

The grain-processing industries are not well represented in the membership of ARI, and it would seem that a better representation might well lead to a strengthening of the research activities in the field of cereal sciences which would be of benefit to these industries. Complete information on the objectives, activities, and membership requirements of ARI may be obtained by writing to ARI or to your technical representative.

LAWRENCE ZELENY
AACC Technical Representative to ARI

AACC LOCAL SECTIONS

Midwest Section members, wives, and their friends enjoyed a gala Christmas party on December 5, with cocktail hour and dinner, the flowing bowl, door prizes, and carol singing; with a quartet leading, the rafters rang. The high spot of the evening was a motion picture, "Wonderful World."

• • • •

Northwest Section members, meeting on November 18th at Jax Cafe in Minneapolis, had as guest and speaker Ernest Guenther of Fritzsche Bros. Dr. Guenther discussed the sources of supply of the essential oils of South America and Africa, and illustrated his talk with some fine color films.

• • • •

Niagara Frontier Section met for dinner on November 14 at Erie County Technical Institute's dining room. Speaker was Jack Monier, chief chemist, General Mills, Buffalo, who traveled recently in South America and Africa and was a keen observer of baking customs and practices on both continents.

• • • •

Southern California Section met on December 6 to hear a talk by William H. Butz of the Beckman Instruments Co. on "Instrumental methods for the analysis of food additives."

Mr. Butz discussed the application of instrumentation to the analysis of food additives. He pointed out that the 1959 food additive law has created many new analytical problems for the quality control chemist. Analysis of food additives at the p.p.m. tolerance level by conventional wet chemical methods is difficult, and in many cases impossible. To meet the requirements of the law, he said, many petitioners have utilized instrumental methods for a practicable means of analysis.

• • • •

Chesapeake Section's meeting on December 1 presented Lawrence Zeleny, chief of Standardization and Testing Branch, Grain Division, USDA, speaking on "My impressions of the grain program as I saw it operate in the Soviet Union." Dr. Zeleny spent a month in the Soviet Union last summer, along with six other

members of the U.S. Grain Handling, Storage, and Processing Mission. Objectives were to observe and inquire into all aspects of these activities, with special emphasis on wheat; the mission covered about 6,000 miles. Many excellent slides accompanied the talk.

At the previous meeting (October 27), the talk by Peter Ivanovich Pogodin, Agricultural Attache of the USSR, along with the film shown, held much interest for its audience. The film was based on the present 7-year plan ending in 1965. Mr. Pogodin explained the development of Soviet agriculture from the old estates to individual holdings, to collective farms, to state-operated farms. Attendance was 38.

FLOUR MILLING

WHEAT UTILIZATION RESEARCH CONFERENCE

Scientists of Northern, Western, and Crops Research Divisions of USDA met on October 4 with technical committees of the Millers' National Federation and the Association of Operative Millers at the Northern Division, Peoria, Ill. Of the 107 persons attending the meeting, 35 were AACC members; of these, 25 represented industrial firms or allied institutions.

Opportunities in industrial utilization of wheat, illustrated by reports on chemical modification of flour, were the theme of the meeting. Technical authorities on paper, textiles, and adhesives as well as milling were on the program; each called for more research on cereal-derived products to adapt them for greater use in his own industry.

Wheat Flour. H. H. Schopmeyer advocated research to modify wheat flour for uses that would not compete with other cereal products. The volume of wheat flour being used industrially, he said, could be expanded if techniques were developed to modify it to produce materials comparable to dextrins, British gums, acid-modified starches, oxidized starches, etc., and if the dispersibility of the gluten could be improved.

"Much of the volume increase would be at the expense of pure starches now being used for these purposes," he said. "It would be most desirable to develop entirely new outlets for cereal products such as in plastics, insulating products, roofing materials, etc., which could grow to large-volume businesses to benefit both agriculture and industry."

Cereals in Paper. John W. Swanson pointed out that starch is a major raw material in the paper industry, which ranks second only to the food industry in the consumption of starches. If cereal products are to hold this place in the rapidly growing paper industry, further research and development both in depth and breadth is required.

The paper chemist gave three reasons why more research in cereal derivatives is needed now: 1. Paper is one of America's "phenomenal-growth" industries because R&D enabled industry leaders to enter new markets. Research and development "is responsible for at least half of the increased paper consumption." 2. Competing resins and synthetic latexes have already taken an important part of new areas of the paper industry. 3. The technology of starch in papermaking has not kept pace with development programs in paper and paperboard or with research by chemical companies in their efforts to develop new products to compete with starch—and chemical industry raw materials are more expensive to produce than raw starch.

More Proteins Found in Gluten. Four wheat-gluten proteins not previously detected were reported at the meeting by J. H. Woychik. This brings the total reported by the Northern Division to eight. Dr. Woychik said the new analytical method should find wide application in further studies of wheat-gluten proteins, especially in studies to compare proteins from different varieties of wheat. It also will provide an additional criterion of purity for components isolated for structural studies.

Zone electrophoresis has theoretical advantages over moving-boundary electrophoresis and has given superior resolution of other proteins with starch gels as the supporting medium. Starch-gel electrophoresis in the presence of concentrated urea proved applicable to wheat gluten proteins. The increased solubility of gluten proteins in the presence of urea permitted study of higher concentrations of protein without detectable changes in composition. Application of the procedure to a water-soluble protein fraction, albumins and globulins, showed nine components which characteristically moved more rapidly than the gluten proteins on electrophoresis.

Why Gluten Is Gluten. More information toward understanding why wheat gluten is unique was reported by H. C. Nielson. He found that only one of the components of gluten protein, the alpha-1 component, has the glutenlike properties of cohesiveness and elasticity—properties that enable gluten to trap and hold gases in bread dough, for example. The function of disulfide bonds in the alpha-1 component was studied because cereal chemists agree that these bonds are in some way related to gluten properties. The work demonstrated that alpha-1 gluten has a basic building block—a polypeptide with a molecular weight of about 21,000. The polypeptide building blocks are held together by sulfur-sulfur bonds to form aggregates with molecular weights extending into the millions. Fragmentation of the alpha-1 component by breaking the disulfide bonds destroys the viscoelastic properties.

Hybrid Molecule for Adhesives. A hybrid molecule that would combine the adhesive advantages of polysaccharides and proteins is one of a number of specific research suggestions by Irving Skeist. He said peptones and other protein hydrolysates are among a vast number of reactants that might have some value with starch.

Major shortcoming of starches and dextrins in adhesive applications is their lack of water resistance; but they also need a better combination of bonding strength, setting speed, tack, solids content, extent of coverage, and flexibility, especially at low tem-

peratures. Crosslinking or modification of cereal-derived adhesives that would improve their water resistance would increase their opportunities in packaging and wood bonding.

Dr. Skeist said: "The rate of growth for starches and dextrins is only 5 percent a year, while synthetic resins are increasing at least four times as fast."

For crosslinking reactions Dr. Skeist suggested using such chemicals as formaldehyde alone or in combinations. "The other technique that would seem promising is the incorporation of water-resistant groups into the starch molecule. The partial esterification of starch with fatty acids would help to take care of two surpluses at once. Graft polymerization offers still another means of modifying the solubility and performance of the starch molecule."

Textile Industry Needs Improved Starches. Research on modification of starch to reduce its biological oxygen demand (BOD) in textile-mill wastes, as well as to improve its effectiveness in textile uses, was called for by H. Jennings. He said such research might protect the market for starch in the textile industry and lead to new markets in and out of the industry. Dr. Jennings cited the case of one textile mill that converted from starch to carboxymethyl cellulose, despite higher costs, to solve the BOD problem.

Sizes for use with synthetic fibers are not satisfactory, Dr. Jennings said; he questioned whether wheat proteins might be used in this way. Glass fibers now are sized with protein formulations, which are burned off when the fabric is completed.

Low-Protein Flour Fractions. V. F. Pfeifer reported obtaining minimum-protein wheat-flour fractions—1.4% protein from soft white winter wheat flour and 4.9% from hard red winter—by fine-grinding and air-classification at the Northern Division. Fractions containing less than 3% of protein might be used directly in industry or after chemical modification.

Six commercial, unbleached, straight-grade flours were fractionated after fine grinding, and the low-protein fractions from each of these were reprocessed by blending, regrinding, and reclassification.

Fractions of lowest protein content were obtained from the softest wheat flours. Fractions containing 3% of protein or less were separated from all of the soft wheat flours but not from hard wheat flours.

A sample of hard red winter wheat flour was fractionated as milled (without fine grinding), and the low-protein fractions were blended and reprocessed. This produces the minimum protein content from HRW wheat flour—4.9%. The 1.4% minimum came from reprocessing a low-protein fraction separated from finely ground Pacific Northwest soft white winter wheat flour. In all cases the separation of low-protein fractions from a blend was facilitated by regrinding before reclassification.

Albumin, Globulin in Flour Fractions. J. W. Pence reported that the ratio of albumin to globulin in fractions of a soft wheat flour tested at the Western Division was about the same as the ratio in the original flour.

He said fine-grinding and air-classification of wheat flours provide a unique opportunity for research on relationships between composition and baking performance. He reported a preliminary investigation of the protein composition of a series of fractions obtained from a club wheat flour by these new milling methods.

A pastry flour derived from Omar variety wheat mixed with a small amount of Brevor variety was separated into a coarse fraction and a fine fraction by air-classification. The fine fraction was mixed with about twice its weight of original flour, and the blend was reground in a pin mill. The reground blend was separated into eight fractions by air-classification. The various fractions were then blended to give three flours of 11.5 to 12.0% protein for bread test-baking, seven flours of 6.5 to 7.5% protein suitable for bleaching and test baking in white cakes, and four flours of 7 to 9% protein appropriate for testing as cookies.

All blends and starting materials were analyzed for total albumin protein and total globulin protein. Values obtained for the original flour are typical for flours milled for club and other low-protein soft wheats. The high-protein fractions, rich in wedge protein, tend to be lower in soluble protein than the low-protein fractions, rich in adhering protein. The ratio of albumin to globulin proteins is about the same for the original flour and these fractions. The very low albumin to globulin ratios obtained are consistent with the very poor breadmaking quality of the flour and its fractions. No correlations between protein composition and cake- or cookie-baking quality were discernible.

Lipids in Flour Fractions. G. O. Kohler reported that in Western Division studies of lipid content of flour fractions, the total lipid content increased with protein content, but proportions of simple and complex lipids were similar in high- and low-protein fractions and in the original flour.

The presence of complexes of lipid and protein constituents in flour, dough, and gluten has been substantiated by various evidence. Flour lipids are known to modify baking characteristics of flours. Information on the nature of lipoprotein components in flour or on the specific lipid and protein components involved in the formation of protein-lipid complexes in doughs or gluten, however, is still little more than fragmentary.

Lipids from high- and low-protein air-classified fractions of a commercial soft wheat flour were compared with those of the original flour. Total lipid content increases with protein content, though divisions into simple and complex lipids are similar for all three flours. Complex lipids from the high- and low-protein flours, fractionated on silicic acid, showed generally similar distributions. These were also similar to results from HRS wheat flour.

Variety Evaluation. Most wheat varieties produce similar proportions of protein under equal growing conditions, said L. P. Reitz of Crops Research Division. He also discussed quality of protein in hard wheats; properties of gluten from Sentry variety of durum; bread-, cake-, and cookie-quality tests; micro-mill tests; and air-classification tests of flours from five wheat varieties.

BOOK reviews

Flour Milling, 4th ed., by J. F. Lockwood; 518 pp., appendices. Northern Publishing Co., Liverpool, England, 1960. Price $15.50. Reviewed by H. H. SCHOPMEYER, International Milling Co., Minneapolis, Minn.

Previous editions of Sir Joseph Lockwood's book were published in 1945, 1948, and 1952. His continuing purpose is "to give a complete and up-to-date description of all the processes of flour milling, from the reception of the wheat to the dispatch of the finished product." The book "is written for the student and the practical miller."

Substantial amounts of new material have been added, particularly on automatic flow control, pneumatic handling in the screen room, new techniques in wheat conditioning, heat-treatment of wheat, protein concentration, and other recent developments. Illustrations are excellent, very clear and well identified. New illustrations are numerous, including some in color, and many of the old ones have been redone to improve clarity. The over-all dimensions have been increased, 8 by 10 page size replacing 5½ by 8½. A particularly interesting feature is the wide left margin, with many of the illustrations in this space.

The book reviews very completely the information on practically all stages of the milling operation. Starting with a brief discussion of types of wheat, the author includes handling, receiving, storage, cleaning, conditioning, and processing. He outlines in great detail the functioning of the various machines in the processing operation, as well as theoretical considerations involved in each step in the entire milling process. Terms are simple enough to make it readily understandable to the average miller. While the descriptions of equipment pertain, for the most part, to that manufactured by Henry Simon, Ltd., the author has described other machines when they differ appreciably from Simon designs and when for some other reason they seem to merit special mention.

American millers will be puzzled when they attempt to compare their own operations with those described by Lockwood in English mills. Capacity is given in inches per sack (280 lb.) per hour, in contrast to the American system of inches per cwt. per day. Flour streams and various mill products are identified in terms entirely unfamiliar to the American miller. However, the author has realized these difficulties and has included several tables giving comparative terms.

The entire book is extremely well written, with very well-done illustrations, and it represents the most complete collection of milling information available. It is certainly a book which both the student and the miller must have in their libraries.

■ ■ ■ ■

Microscopic-Analytical Methods in Food and Drug Control, Food and Drug Technical Bulletin No. 1, ed. by Kenton L. Harris et al., Food and Drug Administration, U. S. Department of Health, Education, and Welfare, 1960; 255 pp., 289 illustrations. Price $2.00 (paper). For sale by Superintendent of Documents, U. S. Government Printing Office, Washington 25, D.C. Reviewed by P. E. RAMSTAD, Minnepolis, Minnesota.

Occasionally a book is published that deserves a place on the reference shelf of every laboratory in the food industry. This is such a book. Moreover, its modest price will make its absence from any such laboratories inexcusable. The authors are recognized authorities in their technical fields. They can also take justifiable pride in a well-written, profusely illustrated, beautifully printed volume.

This bulletin replaces an earlier publication, Food and Drug Circular No. 1, "Microanalysis of Food and Drug Products," which was intended to train analysts. While this is one of the purposes of the new publication, too, this one goes much further into the principles and current philosophy of sanitation work. It is intended to serve the needs of administrators, inspectors, and attorneys, as well as those of analysts working in the laboratory.

Following an introduction, which outlines the purposes both of the book and the Pure Food Law, there are eleven chapters covering product control and sanitation; sources and types of contamination; isolation and detection of contamination; microscopes, photomicrography, and exhibits; fungi associated with food decomposition; entomology in food and drug analysis; parasites and related forms; rodent and other animal filth in foods and drugs; applied histology of food and drug materials; crystallography and chemical microscopy; and identification of drug tablets and capsules.

The book has obvious reference value to all whose activities or responsibilities lie wholly or in part within the areas described. It deserves an even wider audience, because of its description of the progress that has been and is being made in the various aspects of applied sanitation. Effective use is made of tools and techniques taken from a variety of scientific disciplines.

Biochemistry of Plants and Animals, by M. Frank Mallette, Paul M. Althouse, and Carl O. Claggett. John Wiley & Sons, Inc., New York, 1960. Price, $9.00. Reviewed by MAJEL MACMASTERS, Kansas State University, Manhattan, Kansas.

This book is subtitled "An Introduction." The preface states that the book originated from "Introduction to Agricultural Biochemistry," by Dutcher, Jensen, and Althouse (1951), but that the present text is essentially new, with broadened coverage.

Subject matter is divided into three major parts: General Biochemistry, Plant Biochemistry, and Animal Biochemistry. Each part is divided into appropriate chapters. Each chapter is quite exhaustively subdivided by center and side headings. The index covers major topics, but is incomplete if it is to be used for finding some specific references.

In a book of 552 pages, intended primarily as an introductory text for undergraduates, it may not be surprising that the only references given are books; one to five are listed at the end of each chapter. Lack of reference to at least the most important original journal articles will, however, limit the usefulness of the volume as "a convenient, condensed review for others professionally interested in biochemistry" (quotation from the jacket).

The authors have condensed tremendously a wide range of material, too often with consequent oversimplification and loss of significance. Unfortunate implications sometimes result. For example, many chemists would dispute the use of suspensions of soluble proteins and large carbohydrate molecules as examples of a homogeneous molecular dispersion (p. 43). Similarly, the bare statement (p. 189) that starch granules of potato tubers are large and that those of rice are very small indicates neither the actual rather large variation in size of potato starch granules, nor the fact that the small individual granules of rice starch occur naturally in relatively large compound granules.

The cereal chemist will be disappointed in this book, both for its cursory treatment of many familiar topics and because of its inaccuracies. A few examples will suffice. The authors indicate the desirability of amylose as a commercial product (p. 189), but fail to mention either the method used in The Netherlands to obtain potato amylose or the fact that such a product is on the market. On the same page, the history of the development of commercial hybrids of waxy corn has been so condensed as to imply that waxy types of cereals originated through the efforts of plant breeders. Actually, the waxy cereal grains have been well known for about a century. Plant breeders in the United States have developed excellent commercial waxy varieties and, in some cases, have recognized and used new mutations, but mutations are not obtained by breeding *per se*.

The supremacy of corn as a source of commercial starch in the United States is based directly on price of the raw material; volume of the crop may, indeed, influence the price, but is not the prime factor in the use of corn for starch production (p. 190). Nor are rice and sweet potato starches commonly produced here.

Some of the errors are quite surprising. An onion is termed a tuber on page 82. It is said (p. 67) that amylose is readily dispersed in water and does not form a gel, and that amylopectin is difficult to disperse and gives a typical gel. On the same page is the implication that starch granules must break during heating in water before a colloidal paste or gel can ensue. The authors do say "may burst" rather than "burst," but no indication is given of the fact that bursting of the granules is unnecessary for the formation of paste and gel. The statement is made, also on page 67, that it is dextrins formed by heat in the presence of water which impart stiffness to starched collars upon ironing. The amylose content of starch from hybrid corn is said to be 22% (p. 189).

Structural formulas have, in some cases, been written unconventionally (p. 67, for example).

It is unfortunate that a broad field, such as cereal chemistry constitutes, should be so poorly and inadequately presented to undergraduates. Many other areas are more fully covered; however, the lack of source references and of detail severely limits the usefulness of the volume to the professional worker.

■ ■ ■ ■

Official Methods of Analysis, Ninth Edition, of the Association of Official Agricultural Chemists, ed. by William Horowitz. Association of Official Agricultural Chemists, Inc., P.O. Box 540, Benjamin Franklin Station, Washington 4, D.C. 789 pp. plus index. 90 illustrations, 30 reference tables. Price, single copies, $17.50 (less for multiple-copy orders). Reviewed by P. E. RAMSTAD, General Mills, Inc., Minneapolis, Minn.

Every five years the AOAC publishes a new revision of its "Official Methods of Analysis." In this 9th edition are included methods adopted at the October 1959 annual meeting or earlier. Reprints of changes adopted in 1960–63 may be ordered for $2.00.

This edition incorporates changes in typography and format to improve readability while conserving space. Extensive use is made of abbreviations and cross-references. These are explained in a section headed "Definitions of Terms and Explanatory Notes."

Development of new analytical methods in the area covered by the AOAC "Official Methods of Analysis" has been given added impetus by enactment of the pesticide and food additive amendments to the Federal Food, Drug, and Cosmetic Act. Expanded treatment is given to pesticides and their residues, flavors, nutritional adjuncts, and drugs in feeds. Notable among the new methods is the frequent use of chromatographic techniques.

AOAC membership is restricted to chemists employed in certain state and federal agencies. However, many chemists in industry also serve as "Associate Referees" and assist members in the development of new or improved methods. These AOAC methods quite generally enjoy a unique legal status and are written into many standards, specifications, and contracts.

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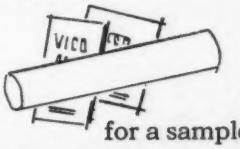

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